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REMARKS

INTERVIEW:

A telephonic interview was conducted on March 11, 2004. The participants were Examiner Lewis A. Bullock, Jr., David Stringer-Calvert and Carina M. Tan. During the interview, an agreement with respect to all the claims were reached. Applicants argued that the prior art teachings of *KISS* did not disclose any intelligent reasoning when formulating a goal satisfaction plan. Applicants argued that *KISS* merely discloses a method of information retrieval from information repositories such as databases. The examiner disagreed. However, the examiner pointed out that certain features in Applicant's specification regarding ICL are novel. The Examiner indicated that the ICL features: 1) a conversational protocol layer, and 2) a content layer, would distinguish applicants' claims over the prior art. It was agreed that applicants would submit a response amending the claims to include the above novel ICL features.

The Examiner is thanked for the performance of a thorough search. By this response, claims 1, 29, 48, 61, 71, 72 and 86 have been amended. No claims have been cancelled or added. Hence, Claims 1-89 are pending in the Application.

IN THE SPECIFICATION

Compact Disc Containing Appendices

Applicants cancel the computer program listing appearing in the specification in Appendices A, B, C, D, and E. In compliance with 37 CFR 1.96(c), Applicants enclose a CD-ROM labeled as Copy 1 and an identical copy of the CD-ROM labeled as Copy 2 containing the identical contents of Appendices A, B, C, D and E as filed with the patent application on January 5, 1999.

Substitute Pages Of Specification

Enclosed are substitute Pages 1, 8 and 9. Substitute Page 1 of the specification has been amended to identify the compact disc and list the file names, size, and creation date of each file, and substitute Page 8 and Page 9 which have been amended to delete the "Brief Description of the Appendices." Also enclosed is a substitute ABSTRACT containing less than 150 words. The ABSTRACT as originally filed contained more than 150 words.

SUMMARY OF REJECTIONS/OBJECTIONS

In the Office Action, Claims 1-3, 5-11, 15-25, 29-34, 38-44, and 61-71 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Developing Tools for the Open Agent Architecture" by Martin1 in view of U.S. Patent No. 6,484,155 issued to Kiss.

Claims 4, 12-14, 26-28, 35-37, 45-47, and 72-85 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin1 in view of Kiss, and further in vie of "Information Brokering in an Agent Architecture" by Martin2.

Claims 48-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Development Tools for the Open Agent Architecture" by Martin1 in view of "Information Brokering in an Agent Architecture" by Martin2.

REJECTIONS UNDER 35 U.S.C. § 103(a)

CLAIMS 1, 29, 61, 71 and 86

Claim 1, as amended, recites in part, the features:

"registering a description of each active client agent's functional capabilities as corresponding registered functional capabilities, using an expandable,

platform-independent, inter-agent language, **wherein the inter-agent language includes:**

a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events; and

a content layer comprising one or more of goals, triggers and data elements associated with the events;

constructing a goal satisfaction plan, wherein the goal satisfaction plan includes:

a suitable delegation of sub-goal requests to best complete the requested service request by using reasoning that includes one or more of domain-independent coordination strategies, domain-specific reasoning, and application-specific reasoning comprising rules and learning algorithms;"

Claim 1 includes the limitation of a inter-agent language, wherein the inter-agent language includes 1) a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, and 2) a content layer comprising one or more of goals, triggers and data elements associated with the events. The cited references do not disclose or suggest such a conversational protocol and content layer.

Further, the Office Action states that the "dynamic solution plan" in *KISS* is the equivalent of the "goal satisfaction plan" of applicants' Claim 1 above. The Office Action points to col. 5, lines 14-45; col. 8, line 21 - col. 9, line 26; and col. 10, lines 10-38, and col. 2, lines 50-67 for support.

The method for forming the "dynamic solution plan" in *KISS* is irrelevant to the method of forming the goal satisfaction plan in Applicants' Claim 1. It is respectfully submitted that *KISS* is irrelevant because *KISS* is an invention involving accessing knowledge repositories. Such knowledge repositories are represented by "knowledge agents." The Abstract of *KISS* states that "the invention solicits accessible knowledge repositories, represented by knowledge agents, for relevant knowledge..."

In other words, *KISS* is merely a method of information retrieval from information repositories or data sources. For example, the meta agent can ask questions involving facts or data and the agents attempt to retrieve the facts or data from the corresponding data repository. In contrast, the goal satisfaction plan of Claim 1 involves asking service providing agents to perform **actions** such as boil water, roast coffee beans, grind the roasted coffee beans as opposed to merely asking the agents to retrieve information from an information repository.

To further explain why *KISS* is irrelevant and completely different from the method of Claim 1, see col. 5 lines 39-43 where "[t]he meta agent 119 is configured to begin executing the solution plan even before the plan is complete." This underscores the fact that the solution plan in *KISS* merely involves information retrieval rather than asking the agent to perform intelligent actions such as roast coffee beans. In *KISS*, it is not fatal to begin executing the solution plan even before the plan is complete because no real harm is done if the meta agent begins by asking the wrong questions. To explain, *KISS* teaches "the meta agent 119 is capable of backtracking or replanning to permit escape from a dead-end." In other words, it is not fatal if the search for data is proceeding down an incorrect search path, as explained in *KISS*. In contrast, the facilitator of Claim 1 cannot begin execution of the goal satisfaction plan before the goal satisfaction plan is complete. For example, it would be fatal for the facilitator to ask a service-providing agent to boil the coffee beans instead of requesting that the coffee beans be first roasted and then ground. Such an action of boiling the coffee beans would be **irreversible** and would produce soggy beans. In other words, the service-providing agents of Claim 1 perform actions and are not merely sources of information.

Further, *KISS* does not use reasoning for "formulating the dynamic solution

plan." In other words, *KISS* does not use the inferencing schemes as described in column 7 for generating the solution plan. In fact, *KISS* teaches away from using reasoning or inferencing for generating the solution plan. Column 8, lines 58-61 of *KISS* states that "**[a]fter** the solution plan is formulated, the meta agent 119 implements a distributed inference process to perform the search and execution phases of solving the problem, while maintaining control of the process" (emphasis added). Thus, the inference process is what the solution plan in *KISS* accomplishes and is not what is used to generate the solution plan.

In contrast, Claim 1 shows that the facilitating engine uses sophisticated reasoning when delegating sub-goal requests to best complete the requested service request. The facilitating engine's use of reasoning is supported by the specification on page 13, lines 342-347.

Assume that the facilitator agent of Claim 1 receives a request such as, "Make Coffee". The facilitator agent's facilitating engine uses reasoning to generate the following goal satisfaction plan:

> Sub-goal request A: Please perform the act of roasting coffee beans
> Sub-goal request B: Please perform the act of grinding coffee beans
> Sub-goal request C: Please perform the act of boiling water, etc.

The facilitating engine is able to use reasoning to accomplish the base goal, "Make Coffee" by asking an appropriate agents to first roast the coffee beans before asking the agent to grind the beans, etc.

Neither *Cohen* nor *KISS*, either alone or in combination, disclose, teach, suggest or make obvious the novel features of claim 1. Thus, Claim 1 is allowable.

Claims 29, 61, 71 and 86, each contain similar features regarding "using reasoning to determine sub-goal requests based on non-syntactic decomposition of the

base goal and using said reasoning to co-ordinate and schedule efforts by the service-providing electronic agents for fulfilling the sub-goal requests in a cooperative completion of the base goal." Thus, Claims 29, 61, 71 and 86 are allowable for at least the reasons provided herein in respect to Claim 1.

CLAIMS 2-28, 30-47, 62-70, 72-85 and 87-89

Claims 2-28 are either directly or indirectly dependent upon Claim 1 and include all the limitations of Claim 1 and therefore are allowable for at least the reasons provided herein in respect to Claim 1.

Claims 30-47 are either directly or indirectly dependent upon Claim 29 and include all the limitations of Claim 29 and therefore are allowable for at least the reasons provided herein in respect to Claim 29.

Claims 62-70 are either directly or indirectly dependent upon Claim 61 and include all the limitations of Claim 61 and therefore are allowable for at least the reasons provided herein in respect to Claim 61.

Claims 72-85 are either directly or indirectly dependent upon Claim 71 and include all the limitations of Claim 71 and therefore are allowable for at least the reasons provided herein in respect to Claim 71

Claims 87-89 are either directly or indirectly dependent upon Claim 86 and include all the limitations of Claim 86 and therefore are allowable for at least the reasons provided herein in respect to Claim 86.

CLAIM 48

Claim 48 as amended, recites in part:

"the ICL having one or more of:

a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events; and
a content layer comprising one or more of goals, triggers and data elements associated with the events;
the ICL having a syntax supporting compound goal expressions wherein said compound goal expressions are such that goals within a single request provided according to the ICL syntax may be coupled by one or more operators from a set of operators comprising:
a conditional execution operator; and
a parallel disjunctive operator that indicates that disjunct goals are to be performed by different agents."

The novel method recited in Claim 48 as amended requires that the inter-agent language include 1) a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, and 2) a content layer comprising one or more of goals, triggers and data elements associated with the events. The cited references do not disclose or suggest such a conversational protocol and content layer.

Further, the novel method recited in Claim 48 as amended requires that "goals within a single request" are "coupled by one or more operators from a set of operators". In amended Claim 48, the set of operators comprise, a conditional execution operator, and **a parallel disjunctive operator**.

In the Office Action, the Examiner states that triggers are conditional operators. It is respectfully submitted that triggers are not conditional operators in the sense of an being a syntactical operator in an expression.

Further, the Office Action states that page 10 of *Martin2* discloses **parallel disjunctive operators**. *Martin2* does NOT disclose parallel disjunctive operators. The "disjunction" in *Martin2* is the run-of-the-mill Prolog style disjunction. The expression, "Do task A OR Do Task B," is an example of a *Martin2* type disjunction. In contrast, a

"**parallel disjunctive operator** is an operator that indicates that disjunct goals are to be performed by different agents. An example of a **parallel disjunctive operator** expression is "Ask agent Bob to do task A OR Ask agent Fred to do task B concurrently.

None of the cited references disclose, suggest or render obvious the requirement that the "**goals within a single request**" be "coupled by one or more operators from a set of operators", such as **a conditional execution operator** (such as "if" and "when", allowing for particular actions to be predicated on the state, or outcomes of earlier actions), and **a parallel disjunctive operator** (allowing for alternative actions to be performed at the same time, if resources allow, and a first-to-respond strategy may be used in their competition to perform the goal at hand). Claim 48 is allowable over the art of record. Thus, it is respectfully submitted that Claim 48 be held in condition for allowance.

CLAIMS 49-60

Claims 49-60 are either directly or indirectly dependent upon independent Claim 48, and include all the features of Claim 48. Therefore, Claims 49-60 are allowable for at least the reasons provided herein with respect to Claim 48. Furthermore, it is respectfully submitted that Claims 49-60 recite additional features that independently render Claims 49-60 patentable over the art of record. Thus, it is respectfully submitted that Claims 49-60 be held in condition for allowance.

CONCLUSION

For the reasons set forth above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a formal Notice of Allowance is believed next in order, and that action is most earnestly solicited.

If in the opinion of the Examiner a telephone conference would expedite the prosecution of the subject application, the Examiner is encouraged to call the undersigned at (650) 838-4311.

The Commissioner is authorized to charge any fees due to Applicants' Deposit Account No. 50-2207.

Respectfully submitted,
Perkins Coie LLP

Date: March 29, 2004

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Software-Based Architecture for Communication and Cooperation Among Distributed Electronic Agents

By:

Adam J. Cheyer and David L. Martin

A compact disk containing a computer program listing has been provided in duplicate (copy 1 and copy 2 of the compact disk are identical). The computer program listing in the compact disk is incorporated by reference herein. The compact disk contains files with their names, size and date of creation as follow:

File Name	Size	Creation Date	Last Date
oaa.pl	159,613 bytes	1996/10/08	1998/12/23
fac.pl	52,733 bytes	1997/04/24	1998/05/06
compound.pl	42,937 bytes	1996/12/11	1998/04/10
com_tcp.pl	18,010 bytes	1998/02/10	1998/05/06
translations.pl	19,583 bytes	1998/01/29	1998/12/23

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is related to distributed computing environments and the completion of tasks within such environments. In particular, the present invention teaches a variety of software-based architectures for communication and cooperation among distributed electronic agents. Certain embodiments teach interagent communication languages enabling client agents to make requests in the form of arbitrarily complex goal expressions that are solved through facilitation by a facilitator agent.

Context and Motivation for Distributed Software Systems

The evolution of models for the design and construction of distributed software systems is being driven forward by several closely interrelated trends: the adoption of a *networked computing model*, rapidly rising expectations for *smarter, longer-lived, more autonomous software applications* and an ever increasing demand for *more accessible and intuitive user interfaces*.

Prior Art Figure 1 illustrates a *networked computing model* 100 having a plurality of client and server computer systems 120 and 122 coupled together over a physical transport mechanism 140. The adoption of the *networked computing model* 100 has lead to a greatly increased reliance on distributed sites for both data and processing resources. Systems such as the networked computing model 100 are based upon at least one physical transport mechanism 140 coupling the multiple computer systems 120 and 122 to support the transfer of information between these computers.

Some of these computers basically support using the network and are known as *client*

FIGURE 9 depicts operations involved in a client agent initiating a service request and receiving the response to that service request in accordance with a certain preferred embodiment of the present invention;

FIGURE 10 depicts operations involved in a client agent responding to a service request in accordance with another preferable embodiment of the present invention;

FIGURE 11 depicts operations involved in a facilitator agent response to a service request in accordance with a preferred embodiment of the present invention;

FIGURE 12 depicts an Open Agent Architecture™ based system of agents implementing a unified messaging application in accordance with a preferred embodiment of the present invention;

FIGURE 13 depicts a map oriented graphical user interface display as might be displayed by a multi-modal map application in accordance with a preferred embodiment of the present invention;

FIGURE 14 depicts a peer to peer multiple facilitator based agent system supporting distributed agents in accordance with a preferred embodiment of the present invention;

FIGURE 15 depicts a multiple facilitator agent system supporting at least a limited form of a hierarchy of facilitators in accordance with a preferred embodiment of the present invention; and

FIGURE 16 depicts a replicated facilitator architecture in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 3 illustrates a distributed agent system 300 in accordance with one embodiment of the present invention. The agent system 300 includes a facilitator agent 310 and a plurality of agents 320. The illustration of Figure 3 provides a high level view of one simple system structure contemplated by the present invention. The facilitator agent 310 is in essence the "parent" facilitator for its "children" agents 320. The agents 320 forward service requests to the facilitator agent 310. The facilitator agent 310 interprets these requests, organizing a set of goals which are then delegated to appropriate agents for task completion.

The system 300 of Figure 3 can be expanded upon and modified in a variety of ways consistent with the present invention. For example, the agent system 300 can be distributed across a computer network such as that illustrated in Figure 1. The facilitator agent 310 may itself have its functionality distributed across several different computing platforms. The agents 320 may engage in interagent communication (also called peer to peer communications). Several different systems 300 may be coupled together for enhanced performance. These and a variety of other structural configurations are described below in greater detail.

Figure 4 presents the structure typical of a small system 400 in one embodiment of the present invention, showing user interface agents 408, several application agents 404 and meta-agents 406, the system 400 organized as a community of peers by their common relationship to a facilitator agent 402. As will be appreciated, Figure 4 places more structure upon the system 400 than shown in Figure 3, but both are valid representations of structures of the present invention. The facilitator 402 is a specialized server agent that is responsible for coordinating agent communications and cooperative problem-solving. The facilitator 402 may also provide a global data store for its client agents, allowing them to adopt a blackboard style of interaction. Note that certain advantages are found in utilizing two or more facilitator agents within the system 400. For example, larger systems can be assembled from multiple facilitator/client groups, each having the sort of structure